

#### ABSTRACT OF THE DISCLOSURE

A theobromine gene derived from Coffee arabica and the polypeptide it encodes are disclosed. The disclosed polypeptide catalyzes biosynthesis of theobromine using 7-methylxanthine as the substrate. Also disclosed are plants transformed with the theobromine gene so as to increase or inhibit biosynthesis of theobromine, methods of producing such plants, and seeds obtained from such plants. Caffeineless coffee may be obtained from the disclosed plants, as theobromine synthase participates in the biosynthesis of caffeine.